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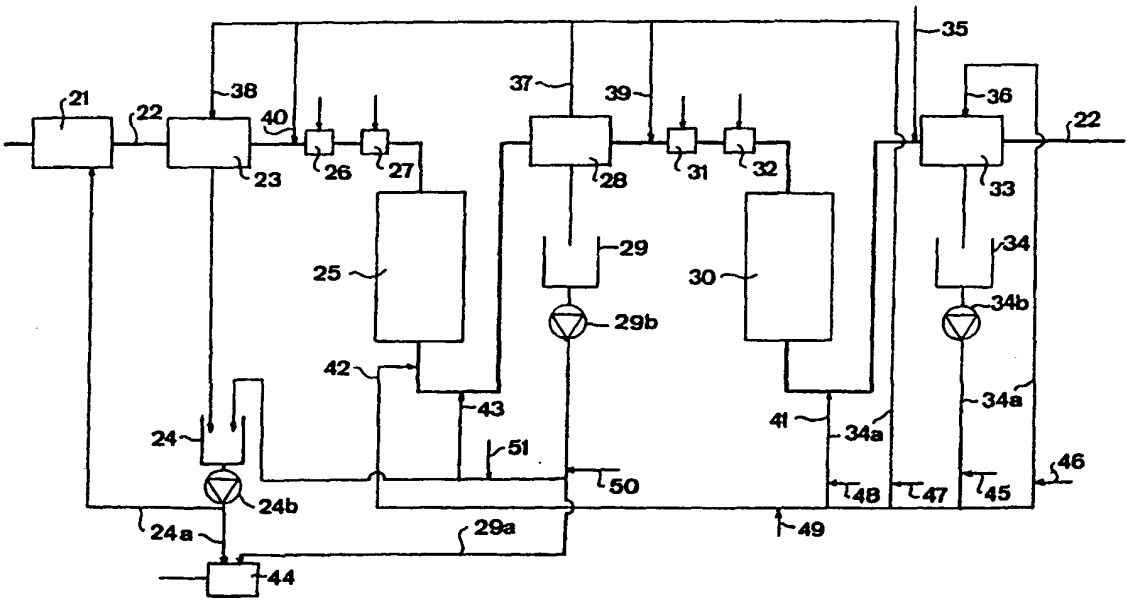

(57) Abstract

A method for the treatment of cellulose fibres in a pulp stream (22) comprises the following steps. A pulp is prepared (21). The pulp is subjected to a bleaching, comprising at least a bleaching step (25, 30) by the addition of an oxidizing bleaching agent. After the bleaching, liquid is removed (28, 33) from the pulp while obtaining a residue liquid and at least a part flow of the residue liquid obtained is conveyed back to the pulp stream (22) via a transport conduit by means of a pump device. Said part flow of the residue liquid is treated by oxygen (45) by the supply of oxygen to the part flow downstream of the pump device.

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TREATMENT OF BLEACH PLANT FILTRATES WITH OXYGEN

THE BACKGROUND OF THE INVENTION AND PRIOR ART

The present invention refers to a method for the treatment of cellulose fibres in a pulp stream, comprising the steps of: preparing a pulp, subjecting the pulp to a bleaching, comprising at least one bleaching step, by the supply of an oxidizing bleaching agent, removing liquid from the pulp after the bleaching while obtaining a residue liquid, and conveying at least a part flow of the residue liquid obtained via a transport conduit directly back to the pulp stream by means of a pump device.

It is known to bleach cellulose pulp in one or several successive bleaching steps by the supply of an oxidizing bleaching agent, such as hydrogen peroxide, and to remove liquid from the pulp after each such bleaching step in such a manner that a residue liquid, the so called filtrate, is obtained. Since this residue liquid still contains a certain amount of the bleaching agent, it is common practice during mechanical pulp bleaching to convey residue liquid back to a preceding washing step or any other possible position in a counter flow in order to utilize available peroxide or other oxidizing bleaching agents instead of conveying it directly to the effluent cleaning plant. In this manner the degree of utilization of the oxidizing bleaching agent may be improved. Also in connection with bleaching of chemical pulp, it would be desirable to be able to convey the residue liquid or the filtrate back to any preceding washing step and further in a counter flow relative to the pulp stream in order to utilize the washing liquid thereby in a maximal manner and minimize the discharge from the bleaching.

The residue liquid obtained forms, after having been conveyed in a counter flow to the pulp flow, an effluent flow which is conveyed to an effluent plant. The effluent flow contains oxygen consuming organic substances, so called COD (chemical oxygen demand), which thus must only be contained in a determined quantity of tons per day in the effluent liquid leaving a pulp plant. Today, it is

possible to decompose such organic substances in the effluent plants available. Nevertheless, problems frequently occur if the percentage of these substances suddenly for any reason is greater than calculated, since the existing effluent plant is dimensioned to manage a certain quantity thereof. Likewise, heavy investment expenses are involved when the requirements from the authorities are made more stringent and the maximal permissible level is decreased.

It is to be pointed out that it is generally considered to be a problem, in connection with the production of chemical pulp, to utilize the residue liquid, or the filtrate, since it is considered to contain organic substances consuming bleaching agents and metal ions being harmful to the bleaching agent. If organic substances or the percentage of metal ions is high, the bleaching result by such a liquid has been unsatisfactory. A return of residue liquid in connection with chemical pulp bleaching results in an increased need of peroxide or other oxidizing bleaching agents in the bleaching reactor for obtaining the same bleaching result.

WO94/21857 discloses a method for removing metals from a filtrate obtained in a dewatering device in a pulp stream. This document discloses the supply of an oxidizing agent, for instance oxygen gas, and alkali to the filtrate in a reactor. In such a manner, the metals dissolved in the filtrate may be percipitated as solid particles and removed therefrom.

The Swedish patent application No 9601709-0 discloses a method for the treatment of cellulose pulp along a pulp stream. The cellulose pulp is bleached in several steps and a residue liquid is separated from the pulp and returned to the pulp stream. Before being returned, the residue liquid is brought into contact with an oxidation gas in a oxidation reactor. According to this document, the preferred oxidation gas is ozone.

EP-A-564443 discloses a method for the treatment of cellulose pulp along a pulp stream comprising bleaching in several steps. A

residue liquid is obtained after a bleaching step and returned to a prior washing step. The residue liquid obtained is heated and conveyed to a reactor to react with oxygen gas. Thereafter, the residue liquid is conveyed to a heat exchanger and from there back to the pulp stream.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a method for solving the problems mentioned above. In particular, an object is to provide a residue liquid, in connection with pulp bleaching, which is less harmful from an environmental point of view and which is more appropriate for being utilized during the treatment of cellulose fibres.

This object is obtained by the method initially defined and characterized in at said part flow of the residue liquid is treated by oxygen by injecting oxygen into said part flow downstream of the pump device. By such an oxygen treatment the percentage of valuable oxidizing components in the residue liquid increases. Thereby, the oxygen may be supplied to the residue liquid under very simple conditions, for instance by injecting oxygen gas to the transport conduit usually existing in a pulp plant for conveying the residue liquid directly back to the pulp stream, i.e. no further oxidizing promoting means, such, as reactors working at high temperature and high pressure, are provided according to the invention. By such a treatment of the residue liquid, possibilities are provided for changing or rendering harmless a significant percentage of the undesired oxygen consuming organic substances and of the undesired harmful metal ions, which are present in the residue liquid when it leaves the bleaching step. This is surprising since previously the opinion was that oxygen may not react to substances in the residue liquid during the mild conditions which normally prevails in the liquid removed from the pulp after the bleaching. In order to provide reactions such as inter alia a reduction of the quantity of organic substances, the opinion previously was that powerful oxidizing conditions were necessary, i.e. a high pressure and a high temperature over 100°C.

Consequently, the residue liquid treated in accordance with the inventive method may in comparison with known technique be taken care of in a more simple manner during the effluent cleaning and is more suitable for being utilized for the treatment of the cellulose fibres. Furthermore, since by the treatment according to the invention the quality of the residue liquid is enhanced a return of the residue liquid to the pulp stream results in an improved effect of the residue liquid. By conveying at least a part flow of the residue liquid obtained directly back to the pulp stream, i.e. without any intermediate treatment or addition of substances, the method according to the invention is characterized by a low complexity enabling application to pulp treatment plants of today.

According to an embodiment of the invention, at least a part of said part flow of the residue liquid may advantageously be conveyed back to the pulp stream before the pulp reaches at least one bleaching step. In such a manner the bleaching may be more efficient, which results in the fact that the brightness of the pulp may be increased or the quantity of hydrogen peroxide added may be reduced with the brightness maintained. Moreover, at least a part of said part flow of the residue liquid may be conveyed back to the pulp stream downstream of a bleaching step.

According to a further embodiment of the invention, oxygen is supplied to the residue liquid before said part flow thereof reaches the pulp stream by injecting oxygen gas into said transport conduit. In such a manner, the oxygen may be supplied at a relatively low pressure, i.e. merely the pressure which appears due to the transportation work which is necessary for transporting the residue liquid back to the pulp stream. Thereby, the oxygen may advantageously be supplied to the residue liquid at such a position that the dwell time of the oxygen in the residue liquid is at least three seconds before said part flow thereof reaches the pulp. According to a further embodiment, said dwell time may be greater than 10 seconds, for instance greater than 30 seconds.

According to a further embodiment of the invention, oxygen is added to said part flow of the residue liquid by injecting oxygen gas into the pulp stream.

According to a further embodiment of the invention, at least a second part flow of the residue liquid obtained is treated by oxygen and supplied to an effluent cleaning step via at least one direct connection, said preparing step, said bleaching step and/or said liquid removing step.

According to a further embodiment of the invention, the oxidizing bleaching agent comprises at least one of hydrogen peroxide, ozone, hypochlorite, peracetic acid and chlorine dioxide. The bleaching effect of such oxidizing bleaching agents may be improved if the residue liquid returned has been treated by oxygen.

According to a further embodiment of the invention, the bleaching comprises at least one first bleaching step and a second bleaching step.

The present invention is applicable to different pulp preparing methods and the pulp may thus comprise at least one of chemimechanical pulp, semi-chemical pulp, mechanical pulp, chemical pulp and secondary fibre pulp.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is now to be explained more closely by means of different embodiments disclosed by way of example and with reference to the drawings attached.

Fig 1 discloses schematically a pulp stream for the treatment of cellulose fibres according to a first embodiment of the invention.

Fig 2 discloses schematically a pulp stream for the treatment of cellulose fibres according to a second embodiment of the invention.

DETAILED DESCRIPTION OF DIFFERENT EMBODIMENTS

According to the first embodiment, disclosed in Fig 1, the pulp of cellulose fibres is prepared in a first process step 1 schematically disclosed. This preparing step 1 may for instance comprise digesting for preparing chemical pulp, repulping for preparing secondary fibre pulp and refining for preparing mechanical pulp. It is already now to be pointed out that the present invention is not limited to any particular type of pulp may be applicable to all known pulp types, for instance chemimechanical pulp, semi-chemical pulp, mechanical pulp, chemical pulp, such as sulphate and sulphite pulp, and secondary fibre pulp. The preparing step 1 schematically disclosed may also comprise screening of the pulp for removing greater particles therefrom.

From the preparing step 1, the pulp is transported along a pulp stream 2 to a first washing device 3, which may comprise one or several washing steps. The washing device 3 disclosed also comprises a dewatering device, for instance in the form of a dewatering press. The residue liquid obtained during the dewatering is transported to a residue liquid tank 4.

The pulp washed and dewatered is transported from the washing device 3 along the pulp stream 2 to a bleaching step 5 comprising a bleaching reactor. Before the pulp reaches the bleaching reactor 5, bleaching chemicals are added by means of a mixing device 6 and steam is added at a steam injection device 7. The bleaching chemicals which are utilized comprises oxidizing bleaching chemicals, such as hydrogen peroxide, ozone, hypochlorite, peracetic acid and chlorine dioxide. In the case of hydrogen peroxide, alkali and silicate may also be added by means of the mixing device 6.

The pulp bleached is thereafter transported along the pulp stream 2 to a second washing device 8, which may comprise one or several washing steps. Also the second washing device 8 comprises a dewatering device, for instance in the form of a dewatering press.

The residue liquid obtained during the dewatering is transported to a residue liquid tank 9.

After the washing in the second washing device 8, the pulp is transported further along the pulp stream 2 to for instance further treatment, drying, storing or to an integrated paper mill. It is to be noted that the pulp in addition to the screening in the preparing step 1 also may be screened at several different locations along the pulp stream 2, for instance between the first washing device 3 and the bleaching step 5 and/or between the bleaching step 5 and the second washing device 8.

Liquid is supplied to the pulp stream 2 in an essentially counter flow manner against the flow direction of the pulp, i.e. relatively clean water is added in the end of the pulp stream 2 while used water, such as the residue liquid obtained, is added in the beginning of the pulp stream 2. This means that in the embodiment disclosed in Fig 1, an essentially clean washing water, or for instance residue water from an integrated paper mill, is added to the pulp stream 2 at 10, i.e. just before the pulp reaches the second washing device 8. Consequently, the residue liquid obtained is transported rearwardly and may be added to the process at one or several positions, for instance it may be added as a dilution to the second washing device 8 at 11 and/or the first washing device 3 at 12. It may also be added to the pulp stream 2 at 13 just before the pulp reaches the bleaching reactor 5, the pulp stream 2 at 14 after the bleaching reactor 5 and/or the preparing step 1 at 15.

A part of the residue liquid which is obtained in the residue liquid tank 4 and 9, respectively, is conveyed back to the process, for instance to the preparing step 1 via a transport conduit, schematically indicated as 4a and 9a, respectively, while another part of the residue liquid is supplied to an effluent treatment device 16 via the transport conduit 4a. The transport conduits 4a, 9a may be realized as a number of pipes, the mere purpose of which are to convey the residue liquid. Pump devices 4b and 9b are arranged on

the transport conduits 4a and 9a, respectively, to provide the necessary transportation work.

According to the present invention, the residue liquid is to be treated by oxygen. This may be performed by adding oxygen to the residue liquid, for instance by an oxygen gas injection directly into the transport conduit 9a at 17 when it leaves the residue liquid tank 9. In such a manner, all residue liquid leaving the residue liquid tank 9 will be treated by oxygen. By the oxygen injection at for instance 18 and/or 19, a more selective treatment of the residue liquid may be performed in accordance with the particular conditions which may prevail in a separate process. It is also to be noted that it is possible to add the oxygen to the residue liquid after it has been supplied to the pulp, i.e. to add the oxygen directly to the pulp by oxygen injection directly into the pulp stream 2. At the positions disclosed for the oxygen addition, generally a relatively low overpressure prevails in the transport conduit 4a, 9a in which the residue liquid is transported. This pressure corresponds to the work which is required for transporting the residue liquid from the residue liquid tank 9 back to the pulp stream 2 and may amount to between 1 and 6 bars (abs), for instance about 4 bars (abs). Furthermore, the temperature of the residue liquid is, at the positions disclosed for the addition of oxygen, relatively low and may be between 50 and 90°C, preferably between 60 and 80°C. The pH-value of the residue liquid at the positions disclosed for the addition of oxygen may be between 7 and 12, preferably between 8 and 10, with regard to basic bleaching agents and between 1 and 7 with regard to acid bleaching agents. If the residue liquid is conveyed back to the pulp at for instance 11 or 14, an approximate dwell time in residue liquid before it reaches the pulp is in the order of 0,5 to 4 minutes. It is to be noted that the dwell time may be influenced by pipe dimensions of the transport conduits 4a, 9a, and other plant specific designs.

Fig 2 discloses a second embodiment which differs from the first embodiment mainly in that it comprises a further bleaching step. According to the second embodiment the pulp of cellulose fibres is thus prepared in a first preparing step 21 in a manner corresponding

to the one of the first embodiment. From the preparing step 21, the pulp is transported along the pulp stream 22 to the first washing device 23, which may comprise one or several washing steps. The residue liquid obtained at the dewatering in the washing device 23 is transported to the residue liquid tank 24. The pulp washed and dewatered is transported further along the pulp stream 22 to the first bleaching step 25. Before the pulp reaches the bleaching reactor 25 bleaching agents are supplied by means of a mixing device 26 and steam is supplied at the steam injecting device 27. The pulp bleached is then transported along the pulp stream 22 to the second washing device 28, which may comprise one or several washing steps, and the residue liquid obtained at the dewatering is transported to the residue liquid tank 29. Thereafter, the pulp is transported further along the pulp stream 22 to the second bleaching step 30 which comprises a bleaching reactor. Before the pulp reaches the second bleaching reactor 30, bleaching chemicals are added by means of a second mixing device 31 and steam at a second steam injecting device 32. The bleaching chemicals utilized according to the second embodiment also comprises oxidizing bleaching chemicals, such as hydrogen peroxide, ozone, hypochlorite, chlorine dioxide and peracetic acid. In the case of hydrogen peroxide alkali and silicate may also be added by means of the second mixing device 31. It is to be noted that different bleaching chemicals and/or different compositions of bleaching chemicals may be utilized in the two bleaching reactors 25 and 30.

The pulp bleached is then transported along the pulp stream 22 to the third washing device 33, which also may comprise one or several washing steps and a dewatering device, for instance in the form of a dewatering press. It is to be noted that according to an alternative embodiment, the third washing device 33 may be replaced by a pure dewatering, for instance by means of a dewatering press. The residue liquid obtain at the dewatering is transported to a third residue liquid tank 34. After being washed in the third washing device 33, the pulp is transported further along the pulp stream 22 to for instance further treatment, drying, storing or to an integrated paper mill. By means of dewatering and return of

residue water, the pulp concentration in the first bleaching step 25 may be between 8 and 20%, preferably about 15%, i.e. a so called MC bleaching step and in the second bleaching step 30 between 20 and 40%, preferably about 30%, i.e. a so called HC bleaching step. Also according to the second embodiment, the pulp may in addition to the screening in the preparing step 21 also be screened at several different locations along the pulp stream 22, for instance between the first washing device 23 and the first bleaching step 25, between the first bleaching step 25 and the second washing device 28 and/or between the second bleaching step 30 and the third washing device 33.

Also according to the second embodiment, liquid is supplied to the pulp stream 22 in an essentially counter flow manner against the flow direction of the pulp, i.e. relatively clean water is supplied in the end of the pulp stream while used water, such as the residue liquid obtained, is supplied in the beginning of the pulp stream. This means that an essentially clean washing water, for instance residue liquid from an integrated paper mill, may be supplied to the pulp stream 22 at 35, i.e. just before the pulp reaches the third washing device 33. The residue liquid obtained in the third residue liquid tank 34 is thus transported rearwardly via the transport conduit 34a by means of the pump device 34b, and may be supplied to the process at one or several positions as exemplified below. It is to be noted that the residue liquid also may be returned to the pulp stream at other positions than those disclosed. The residue liquid from the third residue liquid tank 34 may for instance be added as dilution to the third washing device 33 at 36, the second washing device 28 at 37 and/or a first washing device 23 at 38. Moreover, the residue liquid may be supplied to the pulp stream 22 at 39 just before the pulp reaches the secondary bleaching reactor 30 an/or at 40 just before the pulp reaches the first bleaching reactor 25. Likewise, it is also possible to supply residue liquid to the pulp stream 22 at 41 after the second bleaching reactor 5 and/or at 42 after the first bleaching reactor. The residue liquid obtained in the second residue liquid tank 29 may for instance via the transport conduit 29a by means of the pump device 29b be returned to the process at 43

after the first bleaching reactor 25 or to the first residue liquid tank 24. The residue liquid obtained in the first residue liquid tank 24 may for instance be returned to the process via the transport conduit 24a by means of the pump device 24b to the preparing step 21. One part of the residue liquid obtained in the first residue liquid tank 24 and the second residue liquid tank 29 may in addition be removed from the process to a waste treatment device 44. It is also possible to convey at least a part of the residue liquid obtained in the third residue liquid tank 34 directly to the effluent treatment device 44. Moreover, Fig 2 discloses a number of examples of positions where oxygen may be added to the residue liquid in accordance with the present invention. Oxygen may for instance be added at 45 when the residue liquid leaves the third residue liquid tank 34. In such a manner all residue liquid leaving the third residue liquid tank 34 will be treated by oxygen. By oxygen addition at for instance 46, 47, 48 and/or 49, a more selective treatment of the residue liquid may take place in accordance with the specific circumstances which may prevail in an separate process. In certain cases, it may also be advantageous to treat the residue liquid from the second washing device 28 by oxygen and to add the latter at for instance 50 or 51 to the residue liquid flow leaving the residue liquid tank 29. Moreover, it is to be noted that according to the second embodiment it is also possible to add the oxygen to the residue liquid after it has been added to the pulp, i.e. to add oxygen directly to the pulp. Also for the second embodiment the values for the pressure, the temperature and the pH-value defined in connection with the first embodiment are applicable.

The present invention is not limited to the embodiments disclosed above but may be varied and modified within the scope of the subsequent claims.

The essentially clean washing water may also be added to the process at other positions than at the last washing device 8 and 33 disclosed, for instance at the associated residue liquid tank 9 and 34 respectively.

It is to be noted that the steam supply at 7, 27, 32 is not necessary for the method according to the invention.

One or several of the washing devices 3, 8, 23, 28 and 33 may be replaced by mere dewatering devices, for instance dewatering presses.

It may be dispensed with the residue liquid tanks 4, 9, 24, 29, 34, i.e. the transport conduits or pipes 4a, 9a, 24a, 29a, 34a may extend from the respective dewatering device directly to the pulp stream 2; 22 or to the effluent treatment device 16; 44.

The dwell time for the oxygen in the residue liquid may be increased by for instance adding oxygen to the residue liquid in any of the residue liquid tanks 9 and 34, respectively.

In an application of the method according to the invention, one has obtained a higher brightness, i.e. 1,5 - 2% ISO higher brightness at a certain hydrogen peroxide supply or about 10-13% decrease of the hydrogen peroxide consumption at a certain brightness. Moreover, an increase of the upper brightness limit by 1,5-2% ISO has been noted. Finally, it has been observed that the quantity of oxygen consuming organic substances in the effluent water has decreased by about 10%.

Claims

1. A method for the treatment of cellulose fibres in a pulp stream (2; 22), comprising the steps of:
preparing (1; 21) a pulp,
subjecting the pulp to a bleaching, comprising at least one bleaching step (5; 25, 30), by the supply of an oxidizing bleaching agent,
removing (8;23,33) liquid from the pulp after the bleaching, while obtaining a residue liquid, and
conveying at least a part flow of the residue liquid obtained via a transport conduit (4a, 9a; 24a, 29a, 34a) directly back to the pulp stream, by means of a pump device (4b, 9b; 24b, 29b, 34b), characterized in that said part flow of the residue liquid is treated by oxygen (17; 45) by injecting oxygen into said part flow downstream of the pump device (4b, 9b; 24b, 29b, 34b).

2. A method according to claim 1, characterized in that at least a part of said part flow of the residue liquid is conveyed back to the pulp stream (2; 22) before the pulp reaches at least one bleaching step (5; 25, 30).

3. A method according to any one of claims 1 and 2, characterized in that at least a part of said part flow of the residue liquid is conveyed back to the pulp stream downstream of a bleaching step (5; 25, 30).

4. A method according to any one of the preceding claims, characterized in that oxygen (17; 45) is added to the residue liquid before said part flow thereof reaches the pulp stream by injecting oxygen gas into said transport conduit (4a, 9a; 24a, 29a, 34a).

5. A method according to claim 4, characterized in that oxygen is added to the residue liquid at such a position (17; 45) that the dwell time of the oxygen in the residue liquid is at least three seconds before said part flow thereof reaches the pulp stream (2; 22).

6. A method according to claim 5, characterized in that said dwell time is greater than 10 seconds, for instance greater than 30 seconds.

7. A method according to any one of the preceding claims, characterized in that oxygen is added to said part flow of the residue liquid by injecting oxygen gas into the pulp stream (2; 22).

8. A method according to any one of the preceding claims, characterized in that at least a second part flow of the residue liquid obtained is treated by oxygen and supplied to an effluent cleaning step (16, 44) via a direct connection, said preparing step (1), said bleaching step (5, 25, 30) and/or said liquid removing step (3, 8, 23, 28, 33).

9. A method according to any one of the preceding claims, characterized in that the oxidizing bleaching agent comprises at least one of hydrogen peroxide, ozone, hypochlorite, chlorine dioxide and peracetic acid.

10. A method according to any one of the preceding claims, characterized in that the bleaching comprises at least a first bleaching step (25) and a second bleaching step (30).

11. A method according to claim 8, characterized in that the residue liquid is obtained (33) from the pulp after the latter has passed the second bleaching step (30) and that at least a part flow (38) of the residue liquid obtained is supplied to the pulp stream (22) before the pulp has reached the first bleaching step (25).

12. A method according to any one of the preceding claims, characterized in that the pulp comprises chemimechanical pulp.

13. A method according to any one of the preceding claims, characterized in that the pulp comprises semi-chemical pulp.

14. A method according to any one of the preceding claims, characterized in that the pulp comprises mechanical pulp.

15. A method according to any one of the preceding claims, characterized in that the pulp comprises chemical pulp.

16. A method according to any one of the preceding claims, characterized in that the pulp comprises secondary fibre pulp.

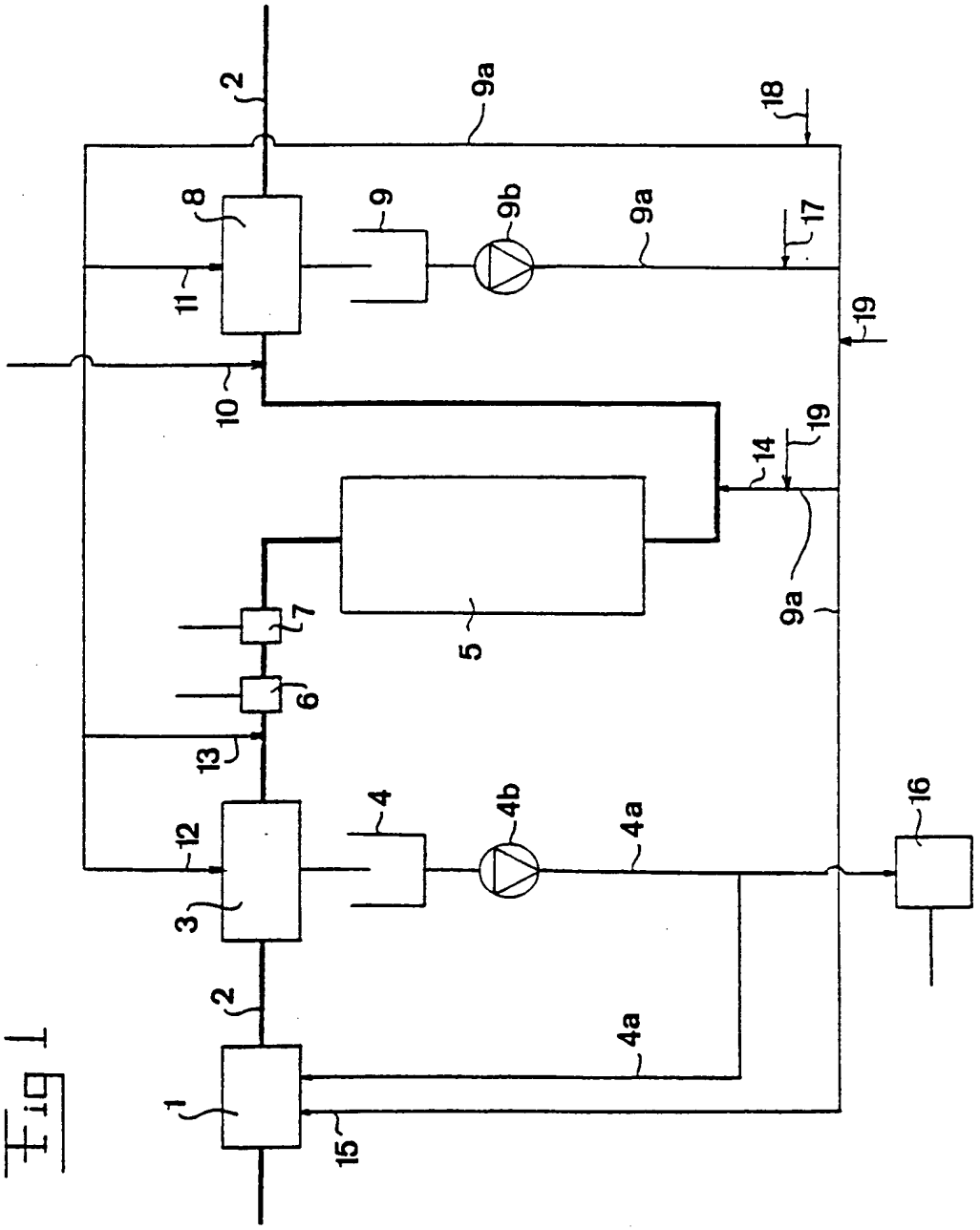

Fig 1

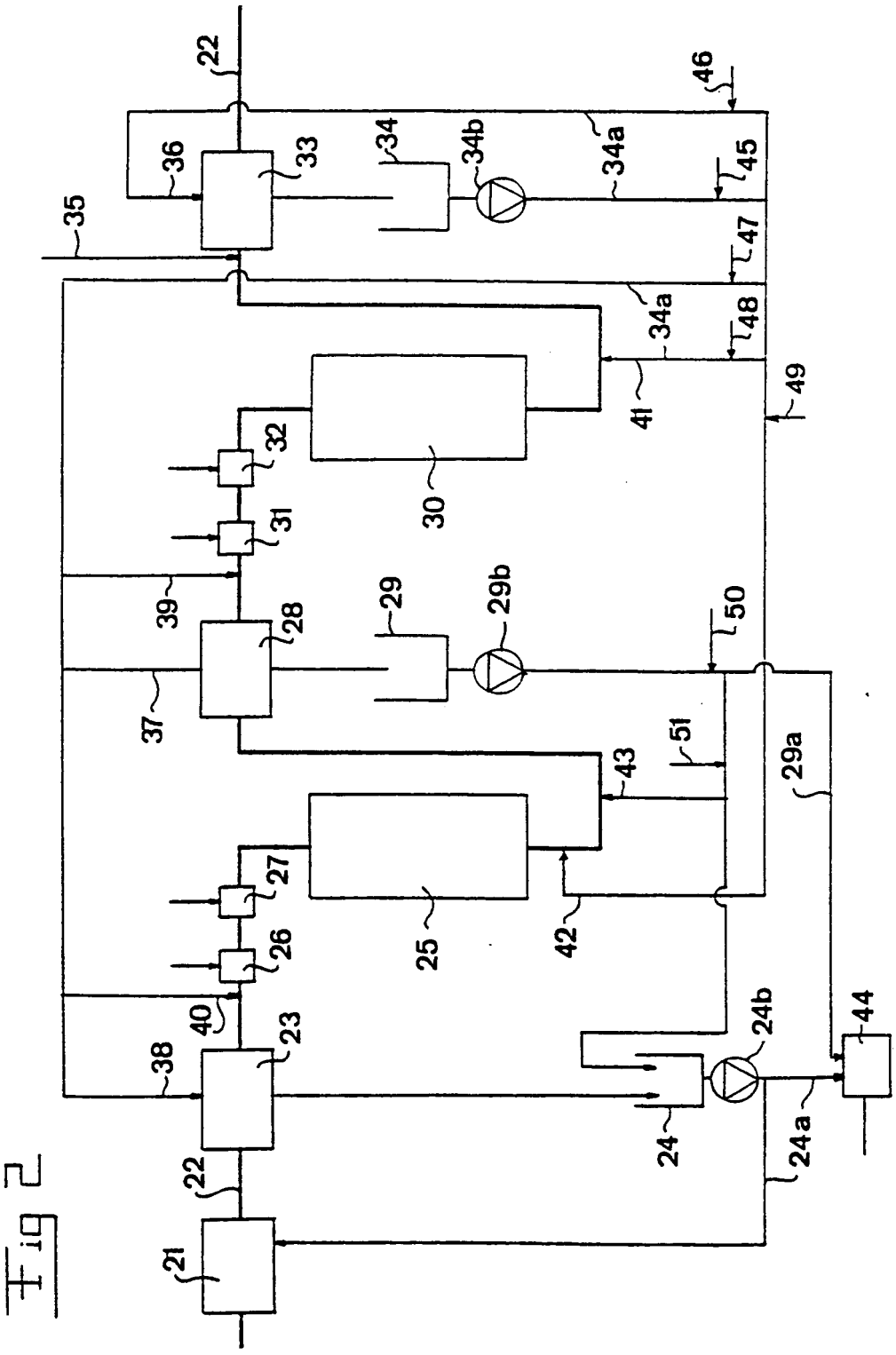
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Fig 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/02214

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21C 9/10, D21C 11/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SE 9601709 A (KAMYR, INC.), 6 November 1996 (06.11.96), page 1, line 21 - page 3, line 7; page 9, line 4 - line 13, figure 1 --	1-16
X	EP 0564443 A1 (KAMYR, INC.), 31 March 1993 (31.03.93), page 2, line 28 - line 41 --	1-16
A	WO 9421857 A1 (KAMYR, INC.), 29 Sept 1994 (29.09.94), figure 2, claims 6,32 -- --------	1-16

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
6 April 1998	16 -04- 1998
Name and mailing address of the ISA Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Marianne Bratsberg Telephone No. + 46 8 782 25 00

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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/03/98

International application No.
PCT/SE 97/02214

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 9601709 A	06/11/96	CA 2170553 A	06/11/96
		FI 961856 A	06/11/96
		JP 8325971 A	10/12/96
EP 0564443 A1	31/03/93	CA 2092948 A	01/10/93
		US 5360514 A	01/11/94
WO 9421857 A1	29/09/94	EP 0642610 A	15/03/95
		FI 945514 A	23/11/94
		JP 7507850 T	31/08/95
		US 5401362 A	28/03/95
		US 5509999 A	23/04/96
		US 5639347 A	17/06/97